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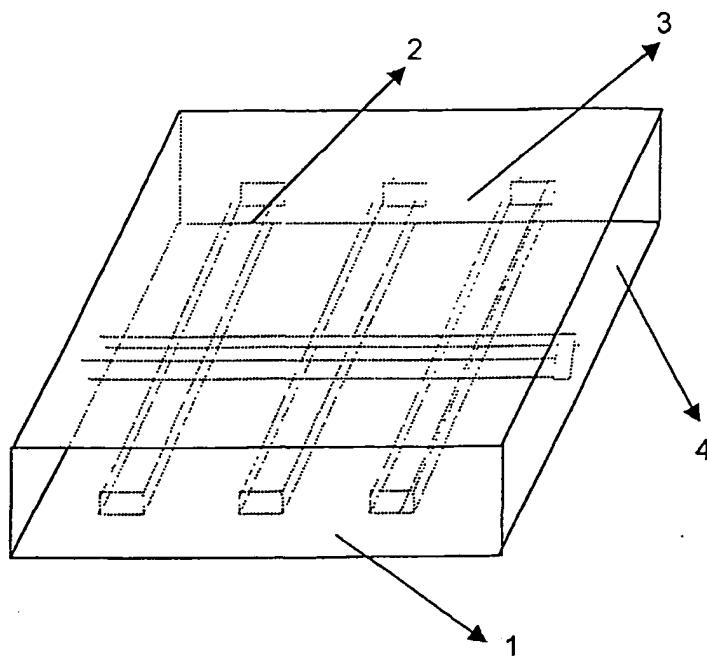
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: THE PRODUCTION METHOD OF LIGHTWEIGHT FLOOR AND WALL PANELS



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(57) **Abstract:** This invention is especially related with the prefabricated floor and wall panels that are widely used for building construction. The production process to obtain the floor and wall panels concerning this invention may generally be described as the pressing and/or extrusion and/or compaction by vibration of the various combinations including varying proportions of the aggregates obtained by the crushing and sieving or all-in use of natural pumice, volcanic ashes, slags, hazelnut shells, siliceous or calcarous stones mixed with organic and/or inorganic admixtures and predefined dosages of portland cements or gypsum to satisfy the design strength requirements. Those panels are produced by having relieves, cavities, grooves on one or all surfaces.

THE PRODUCTION METHOD OF LIGHTWEIGHT FLOOR AND WALL PANELS

5 This invention is especially related with the prefabricated floor and wall panels that are widely used for building construction. The production process to obtain the floor and wall panels concerning this invention may generally be described as the pressing and /or extrusion and/or compaction by vibration of the various combinations including varying proportions of the aggregates obtained by the crushing and sieving or all-in use of natural

10 pumice, volcanic ashes, slags, hazelnut shells, siliceous or calcearous stones mixed with organic and/or inorganic admixtures and predefined dosages of portland cements or gypsum to satisfy the design strength requirements.

15 Cement panels reinforced with wood fibers form a good example for the wall and floor panels used in the modern building construction industry. However, conventional cement mortars cannot be applied at these panels, which do not possess an adequate volumetric stability and surface texture. Moreover, these panels show time dependent permanent deformations and can not include steel reinforcement. Also architectural coverings (ceramics or stone tiles) cannot be applied with conventional mortar, at these panels.

20 Another example for the floor and wall panels produced and marketed with modern techniques are gypsum boards which show the same disadvantages, as in the case of wood fiber-cement panels:

- They cannot be plastered with conventional cement mortars.
- Time dependent permanent deformations may happen.
- 25 - They do not include steel reinforcement.
- Moreover gypsum panels cannot be used in mediums in direct contact with water such as exterior building walls.

 Foamed concrete panels form also a good example for the wall and floor panels used since a few decades in building constructions. However, these panels having relatively

large production sizes, create additional costs in handling, transporting and for site applications, the use of mobile cranes is indispensable.

Although foamed concrete panels may include reinforcement, with relatively high creep rates and low modulus of elasticity, they show larger deformations under sustained 5 loading with respect to the panels concerning this invention.

The use of raw materials that are cheap and abundant in Turkey was planned for the production process of the panels concerning this invention with which it was aimed to obtain conventional plasters and architectural coverings applicable, volumetrically stable, easily transportable and mountable, economical lightweight boards with the required heat 10 and sound insulation capacity.

The drawings prepared for a better description of the production methods to obtain lightweight floor and wall panels and the panels produced according to these methods are as follows.

Drawing 1- Schematical representation of the floor and wall panel
15 Drawing 2- Schematical representation of one side insulated floor and wall panel
Drawing 3- Schematical representation of sandwich type floor and wall panel

Each item describing the drawings is numbered and named as follows:
1- Panel
2- Inner reinforcement
20 3- Lightweight concrete
4- Edge reinforcement
5- Insulating layer.

For the production of the panels concerning this invention, natural pumice, volcanic ashes, slags, hazelnut shells, siliceous or calcareous aggregates at different proportions 25 mixed with organic or inorganic admixtures when necessary and inorganic binders such as Portland cements or gypsum with varying dosages are used.

The aggregates used for the production are brought to a suitable granulometry by crushing and sieving or used in ' all in ' composition. The aggregate is then mixed, pressed and/or extruded or compacted by vibration with the reinforcement conforming the designed 5 form and quantity to obtain the panels concerning this invention.

The aggregate and admixture proportioning that is used for the production of the panels developed by this invention as a percentage of the total aggregate weight are as follows:

- 0 % to 100 % natural pumice
- 10 - 0% to 100 % expanded natural perlite
- 0% to 100 % volcanic ashes
- 0% to 100 % slags.
- 0% to 100 % hazelnut shells
- 0% to 80% siliceous and/or calcareous aggregates
- 15 - 0% to 30 % organic admixtures
- 0% to 30 % inorganic admixtures.

The given aggregate and admixture percentages may be combined according to the required panel properties or a unique aggregate and /or admixture may be used. The inorganic binder dosage is in the range of 100 to 1000 kg/m³

20 The air dry unit weight of the panels concerning this invention, depending on the aggregate type to be used is within 200 kg/m³ to 2000 kg/m³ range.

The production methods to obtain lightweight floor and wall panels and the panels (1) produced according to these methods may include reinforcement (2) of required shape, form and quantity for ease in handling and application or for simply increasing the flexural 25 strength of the material. The mentioned reinforcement may be placed in the body and/or at the surfaces and/or at the edges of the panels concerning this invention.

The production methods to obtain lightweight floor and wall panels and the panels produced according to these methods may be produced at prespecified dimensions or may be obtained by cutting the finished and hardened plates of relatively larger dimensions being maximum 320 cm. to 320 cm. The panel thickness may be within the range of 1 cm to 5 cm. The preferred panel thickness is 3 to 6 centimeters.

One or all surfaces of the panels concerning this invention may be produced with grooves, cavities or relieves for aesthetical purposes or for maximizing the adherence between the panel and plaster that will be later applied on the panel. The panels may be colored during or after the production by using organic or inorganic coloring agents. Also 10 panels of different colors may be produced.

A layer of insulating material (5) such as rock or glass wool or polystyrene foam or others of required thicknesses satisfying the regional codes preferably 1 to 15 centimeters may be added to the panels concerning this invention during the production process. Such an insulating layer may also be added to the panel during the application phase, at the site, 15 by different ways such as gluing, nailing or pressing, etc.

The panels concerning this invention may be produced in sandwich type that is the insulating layer may be placed between two parallel plates. Such products may include vertical reinforcement connecting the two parallel plates.

The panels concerning this invention are applied, at site, by screwing the panels on a 20 steel construction or reinforced concrete member satisfying the project requirements and details, using adequate screws.

The panels concerning this invention can be produced at various dimensions and colors.

CLAIMS

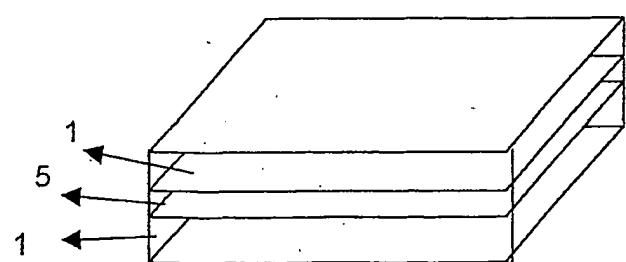
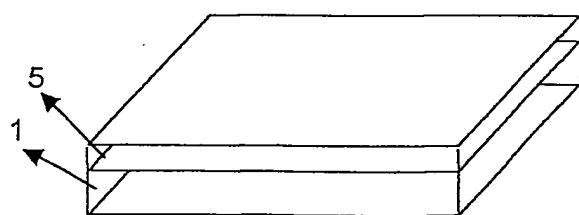
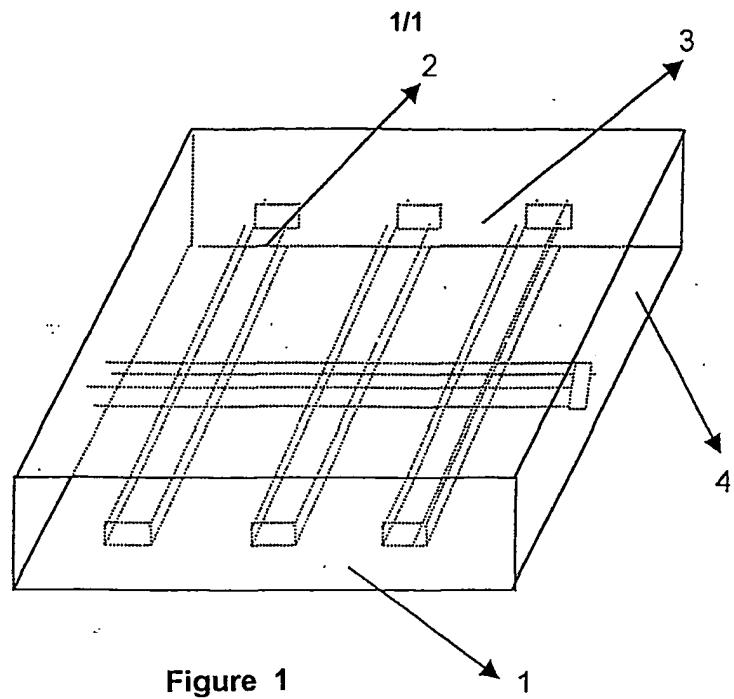
- 1- The production method of lightweight floor and wall panels and panels produced according to this method characterized by:
 - conventional mortar plasters applicable, volumetrically stable, undefor mable, permitting the application of architectural or useful coverings on its surface, possessing the required insulation design values, easily feasible, transportable, applicable and economical, with satisfactory strength and durability,
 - being produced, as a percentage of the total aggregate weight 0 % to 100 % natural pumice, 0 % to 100 % expanded perlite, 0 % to 100 % volcanic ashes, 0 % to 100% slags, 0 % to 100 % hazelnut shells, 0 % to 80 % siliceous aggregates, 0 % to 80 % calcareous aggregates, 0 % to 30 % organical admixtures, 0 % to 30 % inorganical admixtures which can be used one by one or in the form of various combinations,
 - being obtained by the pressing and/or extruding and/or compacting by vibration of the prementioned aggregate composition mixed with Portland cements or gypsum, including also a predesigned amount, shape and form of reinforcement,
 - being dried in air,
 - unit weight varying between 200 kg/ m³ and 2000 kg/m³
- 2- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claim 1 and characterized by obtaining the aggregate by the crushing and sieving or by using in 'all-in' form to be brought to the required granulometry.
- 3- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claim 1 and characterized by the Portland cements being mixed with aggregate to be within the range of 100 kg/m³ to 1000 kg/m³ dosages in order to reach the design strength values.

- 4- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1 and 2, and characterized by the use of gypsum instead of Portland cements.
- 5- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1,2,3 or 4 and characterized by the use of % 100 natural pumice as aggregate
- 6- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1,2,3 or 4 and characterized by the use of % 100 slags as aggregate.
- 10 7- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3 or 4 and characterized by the use of % 100 hazelnut shells as aggregate.
- 8- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3 or 4 and characterized by the use of % 100 volcanic ashes as aggregate.
- 15 9- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3 or 4 and characterized by the use of % 100 expanded perlite as aggregate.
- 10- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3 or 4 and characterized by the use of the combinations of pumice, slags, hazelnut shell, volcanic ashes, expanded natural perlite aggregates where each aggregate type percentage with respect to the total aggregate weight vary between 0 % to 100 %.
- 20 11- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3 or 4 and characterized by the use of 0 % to 80 % siliceous aggregates, 0 % to 80 % calcareous aggregates, 0 % to 30 % organical admixtures, 0% to 30 % inorganical admixtures with respect to the total aggregate weight. The mentioned materials added to the mixe
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may be used uniquely or in various combinations remaining in the given percentage limits.

- 12- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 9, 10 or 5 11 and characterized by including reinforcement, specially shaped steel profiles etc. placed parallel or vertically with respect to the panel plane, aiming to increase the strength of the panel or to ease the realization of site application details.
- 13- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 10 11 or 12 and characterized by possessing reinforcement within the body of the panel or at its surfaces or edges.
- 14- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 11, 12 or 13 and characterized by producing at the predefined sizes or obtained by cutting a relatively larger plate of 320 cm. to 320 cm maximum sizes.
- 15- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 or 14 and characterized by having thicknesses varying between 1 and 20 centimeters and preferably at the range of 3 to 6 centimeters.
- 20 16- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15 and characterized by possessing on one or all surfaces, relieves, 25 cavities, grooves that the manufacturer or the project requirements impose, for aesthetical purposes or to improve the adherence between the panel surface and later on applied plasters and mortars.
- 17- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 or 16 and characterized by coloring during or after production by the use of organical or inorganical coloring agents.

- 18- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 or 17 and characterized by possessing an insulating layer of glass or rock wool; polystyrene foam or other insulating materials to satisfy the heat insulation criteria; the layer being added to the panel during or after the production process.
5
- 19- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 or 18 and characterized by addition of the insulating layer to be made when necessary or required, at the site during the application of the panel by the use of ways such as gluing or pressing.
10
- 20- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 or 19 and characterized by placing the insulating layer as 'sandwich form'.
15
- 21- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20 and characterized by including vertical reinforcement to link the parallel plates of the sandwich types when necessary.
20
- 22- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 or 21 and characterized by application to a steel construction or reinforced concrete member by conforming the project design requirements by the use of adequate screws.
25
- 23- The production method of lightweight floor and wall panels and panels produced according to this method which is conforming to the claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 or 22 and characterized by having unit weights preferably varying between 800 to 1200 kg/m³ depending on the proportioning and type of the materials used during production.



INTERNATIONAL SEARCH REPORT

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| Inter | Application No |
| PCT/TR 01/00058 | |

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C04B28/02 C04B38/08 E04F13/14 E04F15/08 //((C04B28/02, 14:14, 14:16, 14:18, 18:14, 18:24)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C04B E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | US 5 772 751 A (KOMPANEETZ BORIS I ET AL) 30 June 1998 (1998-06-30) claims 1,3,5-7,10 | 1-3,5,6, 8-11,23 |
| X | US 2 877 135 A (ARTUR WAGNER ET AL) 10 March 1959 (1959-03-10) claim 1 | 1-3,5,6, 8-11 |
| X | CHEMICAL ABSTRACTS, vol. 111, no. 14, 2 October 1989 (1989-10-02) Columbus, Ohio, US; abstract no. 119945n, page 294; XP000153368 abstract & PROM-ST., STROIT.ARKHIT. ARM, vol. 11, 1988, pages 64-66, USSR | 1,10,11 |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Inter. Application No.
PCT/TR 01/00058

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|---|-----------------------|
| X | US 1 800 024 A (CARL MARCZINCZEK) 7 April 1931 (1931-04-07) claim --- | 1-4,10 |
| X | WO 84 00970 A (STAVRAKELIS ALEX ;STAVRAKELIS PANAGIOTIS (GR)) 15 March 1984 (1984-03-15) page 2, line 7-20 page 5, line 8-11 --- | 1,7 |
| X | WO 95 02561 A (RIGRO INC) 26 January 1995 (1995-01-26) claims 1,2 --- | 1,22,23 |
| X | EP 0 049 733 A (KARAPANOS THOMAS ;MAVROPOULOS THEODOROS (GR)) 21 April 1982 (1982-04-21) claims 6-9 --- | 1,8-11 |
| A | FR 755 029 A (REB MAURICE-ALBERT) 18 November 1933 (1933-11-18) claims --- | 1-23 |
| A | DE 40 09 906 C (DEUTSCHE PERLIT) 16 May 1991 (1991-05-16) claims 1,4 --- | 1-23 |
| A | DE 196 24 409 A (DIETZSCH OTTO) 30 January 1997 (1997-01-30) the whole document --- | 1-23 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

| | |
|-----------------|----------------|
| Inte | Application No |
| PCT/TR 01/00058 | |

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
|--|---|------------------|--|--|--|
| US 5772751 | A | 30-06-1998 | NONE | | |
| US 2877135 | A | 10-03-1959 | NONE | | |
| US 1800024 | A | 07-04-1931 | NONE | | |
| WO 8400970 | A | 15-03-1984 | GR 69554 A1 AU 9126682 A EP 0113721 A1 WO 8400970 A1 | | 30-06-1982 29-03-1984 25-07-1984 15-03-1984 |
| WO 9502561 | A | 26-01-1995 | WO 9502561 A1 US 5759260 A | | 26-01-1995 02-06-1998 |
| EP 0049733 | A | 21-04-1982 | GR 65942 A1 DK 295181 A EP 0049733 A1 FI 811977 A NO 812140 A PT 73393 A ,B | | 09-01-1981 10-04-1982 21-04-1982 10-04-1982 13-04-1982 01-08-1981 |
| FR 755029 | A | 18-11-1933 | NONE | | |
| DE 4009906 | C | 16-05-1991 | DE 4009906 C1 DE 4103833 A1 | | 16-05-1991 02-10-1991 |
| DE 19624409 | A | 30-01-1997 | DE 19624409 A1 | | 30-01-1997 |